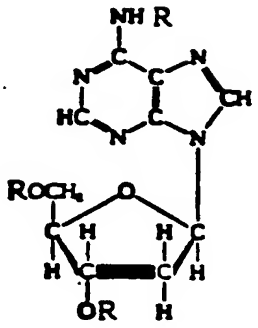
WHAT IS CLAIMED IS:

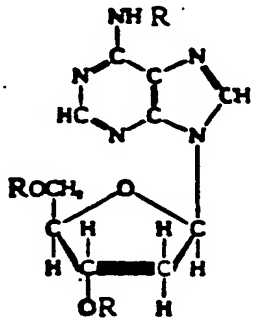
1. An acyl derivative of 2'-deoxyadenosine, having the formula



(I)

wherein R is hydrogen or an acyl radical of a metabolite other than acetyl, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

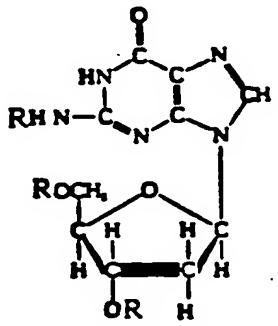
2. An acyl derivative of 2'-deoxyadenosine, having the formula



(I)

wherein R is H or an acyl group derived from a carboxylic acid selected from one or more of the group consisting of pyruvic acid, lactic acid, enolpyruvic acid, an amino acid, a fatty acid other than acetic acid, lipoic acid, nicotinic acid, pantothenic acid, succinic acid, fumaric acid, p-aminobenzoic acid, betahydroxybutyric acid, orotic acid, and carnitine, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

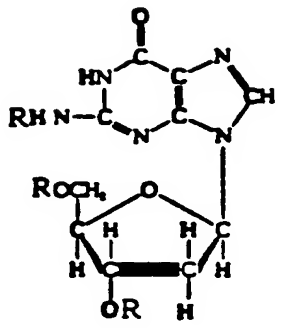
3. An acyl derivative of 2'-deoxyguanosine, having the formula



(II)

wherein R is hydrogen or an acyl radical of a metabolite other than acetyl, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

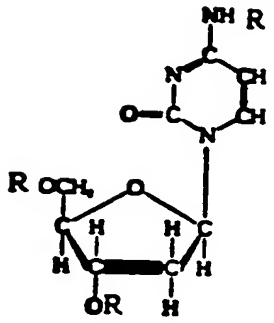
4. An acyl derivative of 2'-deoxyguanosine, having the formula



(II)

wherein R is H or an acyl group derived from a carboxylic acid selected from one or more of the group consisting of pyruvic acid, lactic acid, enolpyruvic acid, an amino acid, a fatty acid other than acetic acid, lipoic acid, nicotinic acid, pantothenic acid, succinic acid, fumaric acid, p-aminobenzoic acid, betahydroxybutyric acid, orotic acid, and carnitine, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

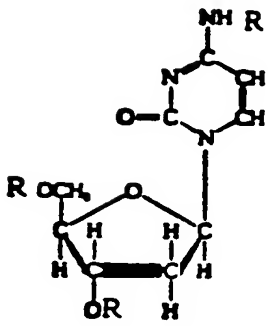
5. An acyl derivative of 2'-deoxycytidine, having the formula



(III)

wherein R is hydrogen or an acyl radical of a metabolite other than acetyl, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

6. An acyl derivative of 2'-deoxycytidine, having the formula

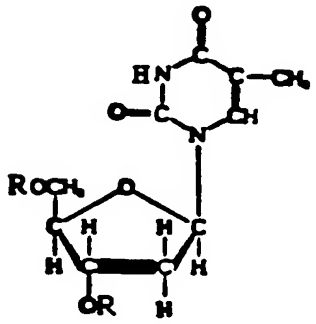


(III)

wherein R is H or an acyl group derived from a carboxylic acid selected from one or more of the group consisting of pyruvic acid, lactic acid, enolpyruvic acid, an amino acid, a fatty acid other than acetic acid, lipoic acid, nicotinic acid, pantothenic acid, succinic acid, fumaric acid, p-aminobenzoic acid, betahydroxybutyric acid, orotic acid, and carnitine, with the proviso that at least one R is not

hydrogen, or the pharmaceutically acceptable salt thereof.

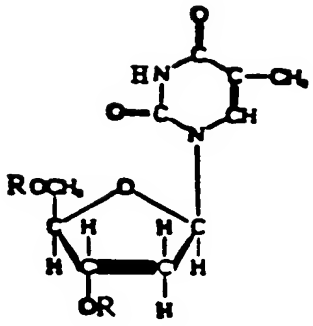
7. An acyl derivative of 2'-deoxythymidine, having the formula



(IV)

wherein R is hydrogen or an acyl radical of a metabolite other than a fatty acid having less than five carbon atoms, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

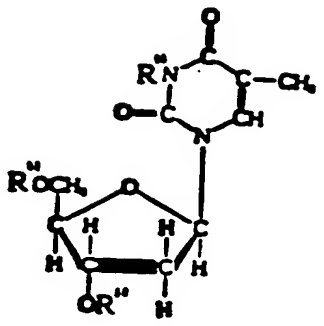
8. An acyl derivative of 2'-deoxythymidine having the formula



(IV)

wherein R is H or an acyl group derived from a carboxylic acid selected from one or more of the group consisting of pyruvic acid, lactic acid, enolpyruvic acid, an amino acid, a fatty acid containing 5 or more carbon atoms, lipoic acid, nicotinic acid, pantothenic acid, succinic acid, fumaric acid, p-aminobenzoic acid, betahydroxybutyric acid, orotic acid and carnitine, with the proviso that at least one R substituent is not hydrogen, or the pharmaceutically acceptable salt thereof.

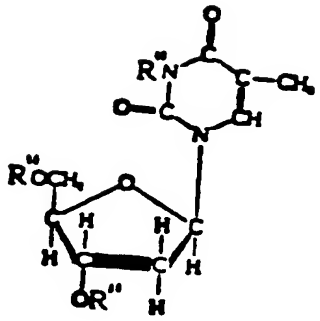
9. An acyl derivative of 2'-deoxythymidine, having the formula



(V)

wherein R'' is hydrogen or an acyl radical of a metabolite, with the proviso that the R'' on nitrogen is not hydrogen, or the pharmaceutically acceptable salt thereof.

10. An acyl derivative of 2'-deoxythymidine, having the formula



(V)

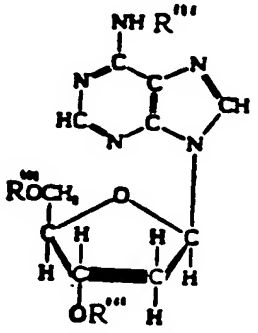
wherein R'' is H or an acyl group derived from a carboxylic acid selected from one or more of the group consisting of pyruvic acid, lactic acid, enolpyruvic acid, an amino acid, a fatty acid, lipoic acid, nicotinic acid, pantothenic acid, succinic acid, fumaric acid, p-aminobenzoic acid, betahydroxybutyric acid, orotic acid, and carnitine, with the proviso that the R'' on nitrogen is not hydrogen, or the pharmaceutically salt thereof.

11. The acyl derivative of claims 2, 4, 6 and 10 wherein said fatty acid is a carboxylic acid having 3-22 carbon atoms.

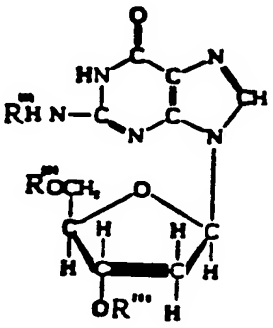
12. The acyl derivative of claims 2, 4, 6, 8 and 10 wherein said amino acid is selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, phenylalanine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, cystine,

methionine, tryptophan, aspartic acid, glutamic acid, arginine, lysine, histidine, ornithine, and hydroxylysine.

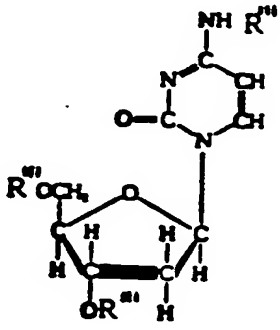
13. A composition comprising at least two of the acyl derivatives of 2'deoxyadenosine (I), 2'-deoxyguanosine (II), 2'-deoxycytidine (III) and 2'-deoxythymidine (IV) having the formulae:



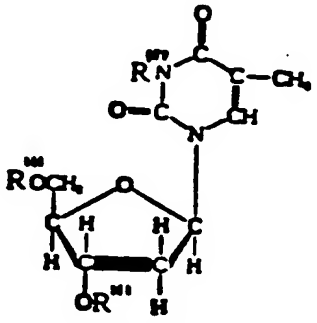
(I)



(II)



(III)



(IV)

wherein R''' is H or an acyl group derived from a carboxylic acid selected from one or more of the group consisting of pyruvic acid, lactic acid, enolpyruvic acid, an amino acid, a fatty acid, lipoic acid, nicotinic acid, pantothenic acid, succinic acid, fumaric acid, p-aminobenzoic acid, betahydroxybutyric acid, orotic acid, and carnitine, with the proviso that at least one R is not hydrogen, or the pharmaceutically acceptable salt thereof.

14. The composition of claim 13, wherein said amino acid is selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, phenylalanine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, cystine, methionine, tryptophan, aspartic acid, glutamic acid, arginine, lysine, histidine, ornithine, and hydroxylysine.

15. The composition of claim 13, wherein said fatty acid is a carboxylic acid having 3-22 carbon atoms.

16. The composition of claim 13, further comprising at least one of the radioprotective compounds selected from the group consisting of: WR-2721, NAC, DDC, cysteamine, 2-mercaptoethanol, mercaptoethylamine dithiothreitol, glutathione, 2-mercaptoethanesulfonic acid, WR-1065, nicotinamine, 5-hydroxytryptamine, 2-β-aminoethyl-isothiouronium-Br-Hbr, glucans, GLP/B04, GLP/B05, OK-432, Biostim, PSK, Lentinan, Schizophyllan, Rhodexman, Levan, Mannozym, MVE-2, MNR, MMZ, IL-1, TNF, thymic factor TF-5, glutathione peroxidase, superoxide dismutase, catalase, glutathione reductase, glutathione transferase, selenium, $CdCl_2$, $MnCl_2$, Zn acetate, Vitamin A, beta carotene, prostaglandins, tocopherol, methylene blue and PABA.

17. A composition comprising one or more compounds as recited in claims 2, 4, 6, 8 or 10 and a pharmaceutically acceptable carrier.

18. A composition comprising an effective amount of one or more acyl derivatives of 2'deoxyadenosine (I), 2'-deoxyguanosine (II), 2'-deoxycytidine (III), and 2'-deoxythymidine (IV) or 2'-deoxythymidine (V) wherein R is acetyl and R'' is acetyl, propionyl or butyryl, with the proviso that at least one R or R'' is not hydrogen, or the

pharmaceutically acceptable salt thereof, and a pharmaceutically acceptable carrier.

19. A composition comprising one or more compounds as recited in claims 2, 4, 6, 8 or 10, at least one radioprotective compound selected from the group consisting of WR-2721, NAC, DDC, cysteamine, 2-mercaptoethanol, mercaptoethylamine dithiothreitol, glutathione, 2-mercaptoethanesulfonic acid, WR-1065, nicotinamine, 5-hydroxytryptamine, 2- β -aminoethyl-isothiouronium-Br-Hbr, glucans, GLP/B04, GLP/B05, OK-432, Biostim, PSK, Lentinan, Schizophyllan, Rhodexman, Levan, Mannozym, MVE-2, MNR, MMZ, IL-1, TNF, thymic factor TF-5, glutathione peroxidase, superoxide dismutase, catalase, glutathione reductase, glutathione transferase, selenium, $CdCl_2$, $MnCl_2$, Zn acetate, Vitamin A, beta carotene, prostaglandins, tocopherol, methylene blue and PABA, and a pharmaceutically acceptable carrier.

20. The composition as recited in claim 17, 18, or 19 in the form of a liquid, a suspension, a tablet, a dragee, an injectable solution, a topical solution, or a suppository.

21. A composition as recited in claim 17 or 18, comprising: 0-50 mole percent of an acyl derivative of 2'-deoxycytidine, 0-50 mole percent of an acyl derivative of 2'-deoxyguanosine, 0-50 mole percent of an acyl derivative of 2'-deoxythymidine, and 0-50 mole percent of an acyl derivative of 2'-deoxyadenosine, the total content of acyl deoxyribonucleosides adding up to 100 mole percent.

22. A composition as recited in claim 21, comprising 25 mole percent of each of the said acyl deoxyribonucleosides.

23. The composition of claim 21, which comprises 3',5'-diacetyl-2'-deoxyadenosine, 3',5'-diacetyl-2'-deoxyguanosine, 3',5'-diacetyl-2'-deoxycytidine and 3',5'-diacetyl-2'-deoxythymidine.

24. The composition of claim 23, which comprises 13-1330 mg of 3',5'-diacetyl-2'-deoxyadenosine, 13-1310 mg of 3',5'-diacetyl-2'-deoxyguanosine, 14-1370 mg of 3',5'-diacetyl-2'-deoxycytidine, and 14-1350 mg of 3',5'-diacetyl-2'-deoxythymidine.

25. A skin lotion containing an effective amount of a composition as recited in claims 17 or 18.

26. The skin lotion of claim 25, wherein said composition is present in from 0.1-5% by weight.

27. A bioerodable microcapsule containing an effective amount of a composition as recited in claims 17 or 18.

28. The composition as recited in claim 27, wherein said bioerodable microcapsules comprise a polymer selected from the group consisting of polylactate and a lactate-glycolate copolymer.

29. A method of enhancing the delivery of exogenous deoxyribonucleosides to the tissue of an animal, comprising the step of administering to said animal an effective amount of an acyl derivative of a deoxyribonucleoside as recited in claims 2, 4, 6, 8 and 10.

30. A method of treating physiological or pathological conditions of the tissue of an animal by supporting the metabolic function thereof, comprising increasing the bioavailability of deoxyribonucleosides to

said tissue by administering to said animal an effective amount of an acyl derivative of a deoxyribonucleoside as recited in claims 2, 4, 6, 8 and 10.

31. A method for treating cardiac insufficiency, myocardial infarction, the consequences of hypertension, cirrhosis of the liver, diabetes, senescence, adrenal insufficiency, the complications of pregnancy, cerebrovascular disorders, senile dementias, Parkinson's disease, demyelinating disorders, cerebellar ataxia, infant respiratory distress syndrome, and lung disorders, or to enhance bone healing or muscle performance, comprising administering to an animal an effective amount of an acyl derivative of a deoxyribonucleoside as recited in claims 2, 4, 6, 8 and 10.

32. A method for treating or preventing radiation-induced cellular damage comprising administering to an animal an effective amount of a composition as recited in claim 17 or 18.

33. The method of claim 32, wherein said composition is administered before or after exposure to radiation.

34. A method for treating or preventing sunlight-induced cellular damage comprising administering to an animal the composition of claim 17 or 18.

35. A method for treating or preventing radiation or sunlight-induced cellular damage comprising administering to an animal an effective amount of a skin lotion as recited in claim 25.

36. A method for ameliorating the effects of aging comprising administering to an animal an effective amount of a composition as recited in claim 17 or 18.

37. A method for treating or preventing mutagen-induced cellular damage comprising administering to an animal an effective amount of a composition as recited in claim 17 or 18.

38. A method for enhancing the healing of damaged tissue comprising administering to an animal an effective amount of a composition as recited in claim 17 or 18.

39. The method of claim 38, wherein said damaged tissue comprises skin wounds.

40. The method of claim 38, wherein said damaged tissue comprises burned tissue.

41. The method of claim 38, wherein said damaged tissue comprises diseased or damaged liver tissue.

42. The method of claim 38, wherein said damaged tissue comprises heart muscle damaged as a result of myocardial infarction.

43. The method of claim 38, wherein said damaged tissue is bone marrow.

44. The method of claim 38, wherein said method enhances erythropoiesis.

45. A method for enhancing the transport of deoxyribonucleosides across the gastrointestinal tract and the blood-brain barrier and thereby enhancing the bioavailability of said deoxyribonucleosides, comprising

administration to an animal of an effective amount of an acyl derivative of a deoxyribonucleoside as recited in claims 2, 4, 6, 8 and 10.

46. A method for enhancing the transport of 2'-deoxycytidine, 2'-deoxyguanosine, 2'-deoxyadenosine, and 2'-deoxythymidine across the gastrointestinal tract and the blood-brain barrier and thereby enhancing the bioavailability of said deoxyribonucleosides, comprising administration to an animal of an effective amount of a composition as recited in claim 13.

47. A method as recited in claims 29, 30, and 31 wherein said animal is a human.